

Project #1 (45 points)

Due Date

- Thursday, September 24, by 11:59pm.

Submission

1. Group Submission (one copy per team)
 - (a) You must designate a submitter (one of the team members) and **submit the zipped project folder** to Canvas.
 - (b) You must include both team members' names in the comment block on top of EVERY Java file.
 - (c) Your project folder must include the following **subfolders/files for grading**.
 - Source folder, including all Java files [25 points]
 - A testbed main, in the ShoppingBag class. [5 points]
 - Javadoc folder, including all the files generated. [5 points]
 - Test design document, typed with a document editor. [5 points]
2. Individual Submission (everyone must submit a copy)
 - Personal time log, using the template posted on Canvas. [5 points]

Project Description

In this project, you will implement an array-based container class **ShoppingBag** and use it to hold a list of grocery items. An instance of the ShoppingBag class is a growable bag with an initial capacity of holding 5 grocery items, and automatically grows (increases) the capacity by 5 whenever it is full. **You CANNOT use the ArrayList class, or 0 points!**

Your program shall allow the user to **add**, **remove** and **display** the items in the bag. In addition, your program shall provide the functionality of **checking out** the grocery items in the bag. Checking out will empty the bag and display the details of the grocery items, including the list of grocery items and the total amount paid. Each grocery item in the list shall include the item name, unit price and taxable or nontaxable. The total amount paid is the sum of the unit price in the list plus the sales tax, which is 6.625%. The sales tax only applies to the taxable items.

Your program shall read the commands from the standard input (keyboard), process the commands and display the results to the standard output (console.) When your project runs, it shall display "Let's start shopping!". Next, it will take the commands from the input and process the commands continuously until the user enters the "Q" command to quit. **All commands are case-sensitive**, which means the commands with lowercase letters are invalid! In addition, you are required to deal with bad commands not supported. You may need to discard the rest of the command line if a bad command is read.

The data tokens of a command line from the standard input are separately by white spaces, i.e., space(s), tab or newline. All commands are single letter commands. For the **Add** and **Remove** commands, you can always assume the next 3 data tokens are the item name, unit price followed by a true or false indicating taxable or not taxable. For simplicity, an item name is a single string. If a multi-word item name is used, underscores "_" or hyphens "-" will be used to connect the words. The details of the valid commands are listed below.

- **A – add** a grocery item to the bag. For example, a command line A milk 2.99 false will add the grocery item "milk" with the unit price "2.99" to the bag. The item is not taxable. If the bag is full, the bag automatically grows the capacity by 5. Display "milk added to the bag." after the item was added.
- **R – remove** an item from the bag. For example, R milk 2.99 false will remove the nontaxable grocery item "milk" with the price "2.99" from the bag. If there are more than one matching item, remove the first item found

in the bag. If the remove was not successful, display “Unable to remove, this item is not in the bag.”; otherwise, display “milk 2.99 removed.”.

- **P – display** all items in the bag on the console. If the bag is empty, display “The bag is empty!”; otherwise, display “**You have X item(s) in the bag: ” where X is the number of items. Your program then displays the list of the grocery items and displays “**End of list” after the last item.
- **C – checking out** the grocery items in the bag. If the bag is empty, display “Unable to check out, the bag is empty!”; otherwise, display “**Checking out X item(s): ”, where X is the number of items in the bag. Your program then lists all items with the sum of the prices “*Sales total: \$xxx.xx”, and then displays: “*Sales tax: \$xx.xx”, “*Total amount paid: \$xxx.xx.” **Note that** a floating-point number is displayed with 2 decimal places.
- **Q –** if the bag is not empty, automatically check out all items; in all cases, display “Thanks for shopping with us!” and stop the program execution.

Program Requirement

1. You MUST follow the software development ground rules. You will lose points if you are not following the rules.
2. There are some test cases (Sample Input) at the end of this document. If you enter the test cases in the same order, your program should generate the same output in the Sample Output section. The graders will be using the Sample Input to test your program. You will **lose 2 points** for each error output produced.
3. You are required to log your times working on this project with the template provided on Canvas. **The time log is an individual assignment. You will lose 5 points** if the log is not submitted. If the times and comments are not properly logged, you will only get partial credits. You must type, hand-writing is not acceptable.
4. Each Java class must go in a separate file. **-2 points** if you put more than one Java class into a file.
5. Your program MUST handle bad commands! The commands are case-sensitive. **-2 points** for each bad command not handled.
6. Your project MUST include at least 4 classes described below. **-5 points** for each class missing.

(a) GroceryItem class.

```
public class GroceryItem {
    private String name;
    private double price;
    private boolean taxable;
    ...
    public boolean equals(Object obj){ }
    public String toString() { }
    ...
}
```

- This class defines the abstract data type GroceryItem, which encapsulates the data fields and methods of a grocery item. You CANNOT add other data members, and you CANNOT change the signatures of the **toString()** and **equals()** methods. **-2 points** for each violation. You should define a parameterized constructor. You can add other methods if necessary.
- You CANNOT do I/O in this class, i.e., read from or write to the console. **-2 points** for each violation.
- **toString()** method returns a string representing the data fields of an object with the format

itemName: \$xx.xx : tax free.

The unit price shall be displayed with 2 decimal places. **-2 points** if the format is not set properly. You can use **System.out.printf()** method or the **format()** method in the **DecimalFormat class** to format a floating point number.

- **equals()** method returns true only if all the data field values of the two objects are the same.

(b) **ShoppingBag** class.

```
public class ShoppingBag {
    private GroceryItem[] bag; // array-based implementation of the bag
    private int size;          // number of items currently in the bag

    public ShoppingBag() { }
    private int find(GroceryItem item) { } // helper method to find an item
    private void grow() { } // helper method to grow the capacity
    public void add(GroceryItem item) { }
    public boolean remove(GroceryItem item) { }
    public double salesPrice() { } // sales total; the sum of the prices in the bag
    public double salesTax() { } // sales tax total of the taxable items in the bag
    public void print() { }
}
```

- This is the **container class** that defines the abstract data type for a shopping bag and its operations. A shopping bag holds an array of grocery items. You CANNOT add other data members, and you CANNOT change the signatures of the methods. **-2 points** for each violation. You must implement all the methods listed, **-2 points** for each method not implemented or not used. You can add other methods if necessary.
- You CANNOT do I/O in this class, except the **print()** method, **-2 points** for each violation.
- The **remove()** method calls the helper method **find()** and finds the index of the grocery item to be removed. Move the last item in the array to replace the removing item with the index, and set the reference of the last item to null.
- You MUST design the test cases for testing **add()**, **remove()**, **grow()** and **salesTax()** methods. The test cases must be documented in a **test document**. You must follow the instructions in the “Test Specification” section of the Software Development Ground Rules. **You will lose 5 points** if you do not submit the test document, or not follow the format.
- You must write a **test bed main** for this class to implement the test cases in the test document, **-1 points** for each method not tested. In the testbed main, you MUST print out the results to the console showing the test cases are passed.

(c) **Shopping** class for handling the I/O.

```
public class Shopping {
    public void run() { }
    ...
}
```

- This class is the **user interface class** that handles the **input** commands, **output** data and messages. You must define a **run()** method or you will **lose 5 points**. The main method in **RunProject1.java** will call the **run()** method here.
- You can define the data members you need and define some private methods to handle the commands. Make sure you follow the ground rules and have a good programming style.

(d) **RunProject1** class (this is a driver class to run your Project 1)

```
public class RunProject1 {
    public static void main(String[] args) {
        new Shopping().run();
    }
}
```

7. You must follow the instructions in the Software Development Ground Rules and comment your code. You are required to **generate the Javadoc** after you properly commented your code. Your Javadoc must include the documentations for the constructors, private methods and public methods of all Java classes. Generate the Javadoc in a single folder and include it in your project folder to be submitted to Canvas. You will **lose 5 points** for not including the Javadoc.

Sample Input

```
r meat 2.99 false
a meat 2.99 false
P
R toast 2.99 false
A toast 4.95 false
A jam 3.95 false
A jam 3.95 false
P
R jam 3.95 false
P
Blah blah blah
a meat 2.99 false
A jam 2.59 false
A jam 2.59 false
A jam 2.59 false
A toast 4.95 false
A jam 3.99 false
P
R jam 2.59 false
P
R toast 4.95 false
P
C
C
R toast 4.95 false
A toast 4.95 false
C
A milk 2.5 false
A salmon 5.99 false
A toilet_papers 7.95 true
A kitchen_towels 10 true
A bagels 3.99 false
A garbage_bags 4.59 true
A laundry_detergent 12.99 true
p
P
A chicken 6.75 false
A pork 4.59 false
A shrimp 13 false
A masks 15.59 true
A sanitizer 2.99 true
A bleach 3.95 true
P
C
q
Q
You shouldn't process this line!
```

Sample Output

```
Let's start shopping!
Invalid command!
Invalid command!
The bag is empty!
Unable to remove, this item is not in the bag.
toast added to the bag.
jam added to the bag.
jam added to the bag.
**You have 3 items in the bag.
·toast: $4.95 : tax free
·jam: $3.95 : tax free
·jam: $3.95 : tax free
**End of list
jam 3.95 removed.
**You have 2 items in the bag.
·toast: $4.95 : tax free
·jam: $3.95 : tax free
**End of list
Invalid command!
Invalid command!
jam added to the bag.
jam added to the bag.
jam added to the bag.
toast added to the bag.
jam added to the bag.
**You have 7 items in the bag.
·toast: $4.95 : tax free
·jam: $3.95 : tax free
·jam: $2.59 : tax free
·jam: $2.59 : tax free
·jam: $2.59 : tax free
·toast: $4.95 : tax free
·jam: $3.99 : tax free
**End of list
jam 2.59 removed.
**You have 6 items in the bag.
·toast: $4.95 : tax free
·jam: $3.95 : tax free
·jam: $3.99 : tax free
·jam: $2.59 : tax free
·jam: $2.59 : tax free
·toast: $4.95 : tax free
**End of list
toast 4.95 removed.
**You have 5 items in the bag.
·toast: $4.95 : tax free
·jam: $3.95 : tax free
·jam: $3.99 : tax free
·jam: $2.59 : tax free
·jam: $2.59 : tax free
**End of list
Invalid command!
**Checking out 5 items.
·toast: $4.95 : tax free
·jam: $3.95 : tax free
·jam: $3.99 : tax free
·jam: $2.59 : tax free
·jam: $2.59 : tax free
*Sales total: $18.07
*Sales tax: $0.00
*Total amount paid: $18.07
Unable to remove, this item is not in the bag.
toast added to the bag.
**Checking out 1 item.
```

·toast: \$4.95 : tax free
*Sales total: \$4.95
*Sales tax: \$0.00
*Total amount paid: \$4.95
milk added to the bag.
salmon added to the bag.
toilet_papers added to the bag.
kitchen_towels added to the bag.
bagels added to the bag.
garbage_bags added to the bag.
laundry_detergent added to the bag.
Invalid command!
**You have 7 items in the bag.
·milk: \$2.50 : tax free
·salmon: \$5.99 : tax free
·toilet_papers: \$7.95 : is taxable
·kitchen_towels: \$10.00 : is taxable
·bagels: \$3.99 : tax free
·garbage_bags: \$4.59 : is taxable
·laundry_detergent: \$12.99 : is taxable
**End of list
chicken added to the bag.
pork added to the bag.
shrimp added to the bag.
masks added to the bag.
sanitizer added to the bag.
bleach added to the bag.
**You have 13 items in the bag.
·milk: \$2.50 : tax free
·salmon: \$5.99 : tax free
·toilet_papers: \$7.95 : is taxable
·kitchen_towels: \$10.00 : is taxable
·bagels: \$3.99 : tax free
·garbage_bags: \$4.59 : is taxable
·laundry_detergent: \$12.99 : is taxable
·chicken: \$6.75 : tax free
·pork: \$4.59 : tax free
·shrimp: \$13.00 : tax free
·masks: \$15.59 : is taxable
·sanitizer: \$2.99 : is taxable
·bleach: \$3.95 : is taxable
**End of list
**Checking out 13 items.
·milk: \$2.50 : tax free
·salmon: \$5.99 : tax free
·toilet_papers: \$7.95 : is taxable
·kitchen_towels: \$10.00 : is taxable
·bagels: \$3.99 : tax free
·garbage_bags: \$4.59 : is taxable
·laundry_detergent: \$12.99 : is taxable
·chicken: \$6.75 : tax free
·pork: \$4.59 : tax free
·shrimp: \$13.00 : tax free
·masks: \$15.59 : is taxable
·sanitizer: \$2.99 : is taxable
·bleach: \$3.95 : is taxable
*Sales total: \$94.88
*Sales tax: \$3.85
*Total amount paid: \$98.73
Invalid command!
Thanks for shopping with us!